Patent Claims

1. A process for producing a hole (7) in a component (1, 120, 130, 155) by means of pulsed laser beams (22),

characterized in that

the process is carried out in a multiplicity of process steps, and
in that shorter laser pulse lengths are used in one of the first process steps than in one of the last process steps.

2. The process as claimed in claim 1,
characterized in that

the laser pulse length is continuously increased as the formation of the hole progresses from an outer surface (14) of the component (1) into the depth of the hole (7).

3. The process as claimed in claim 1 or 2,
characterized in that

in a first process step, laser pulse lengths of less than 100 ns, in particular less than 50 ns, are used, and
in one of the last process steps laser pulse lengths of greater than or equal to 50 ns, in particular greater than or equal to 100 ns, and less than 10 ms are used.

4. The process as claimed in claim 1, characterized in that

the process is carried out on a component (1), the component (1) forming a layer system.

5. The process as claimed in claim 4, characterized in that

the process is carried out on a layer system (1) which comprises a metallic substrate (4) and at least one ceramic layer (16).

6. The process as claimed in claim 4 or 5, characterized in that

the layer system (1) comprises a substrate (4) and a metallic layer (16),
which in particular has a composition of the MCrAlX type,
where M stands for at least one element selected from the group consisting of iron, cobalt or nickel,
and X stands for yttrium and/or at least one rare earth element.

7. The process as claimed in claim 5 or 6, characterized in that

the layer system (1) comprises a substrate (4) and a layer (16),
which includes a metallic interlayer and an outer ceramic layer.

8. The process as claimed in claim 5 or 7, characterized in that

the ceramic layer (16) is a thermal barrier coating.

9. The process as claimed in claim 5, 6, 7 or 8, characterized in that

the substrate (4) is a nickel-base, cobalt-base or iron-base superalloy.

10. The process as claimed in claim 1, characterized in that

the process is carried out on a component (1), which is a turbine blade or vane (120, 130), a combustion chamber lining (155), or another component of a gas turbine (100) or steam turbine.

11. The process as claimed in claim 1 or 10, characterized in that

the process is used during the production of a new component (1, 120, 130, 155).

12. The process as claimed in claim 1 or 10, characterized in that

the process is used for a component (1, 120, 130, 155) which is to be refurbished.

13. The process as claimed in claim 1, characterized in that

at least two and in particular more lasers (19, 19') which can generate different ranges of laser pulse lengths are used.

14. The process as claimed in claim 1, characterized in that

first of all an outer upper region (13) of the hole (7) is produced using short laser pulse lengths,
and then a second subregion (10) of the hole (7) is produced using longer laser pulse lengths.

15. The process as claimed in claim 1, characterized in that

in a first process step, an outer upper region (28) of the hole (7) is produced,
then in one of the last process steps an inner region (25) of the hole (7) is produced.

16. An apparatus (40) for machining a component (1), in particular as described in one or more of the preceding claims,
comprising at least two lasers (19, 19') which generate different laser pulse lengths.

17. The apparatus as claimed in claim 16, characterized in that

the apparatus (40) has at least one mirror (31, 33), which is used to divert a laser beam (22) onto the component (1) that is to be machined.

18. The apparatus as claimed in claim 16 or 17, characterized in that

the apparatus has at least one optical system (35), in particular one optical system (35), which guides the laser beams (22', 22'') from the lasers (19, 19') onto the component (1).

19. The apparatus as claimed in claim 16 or 17, characterized in that

the apparatus has at least one optical system (35), so that the laser beams (22', 22'') from the lasers (19, 19') are simultaneously guided onto the component (1).